

A Mobile App Supporting Exercise Adherence for People with Parkinson's Disease

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Abstract. Researches have shown that physical exercise in patients with Parkinson's disease (PD) is an effective method reduce or limit the progress of the disease and improve physical and psychological health. However, exercise adherence is a challenge task. Many existing mobile exercise apps did not consider the special conditions of people with PD. This paper aims to design a mobile app to support physical exercise adherence among people with PD. Through the design of the app, we hope to test and contribute to the improvement of the existing guidelines and recommendations for mobile apps for people with PD.

Keywords: Parkinson's disease, exercise adherence, mobile app.

1 Introduction

Parkinson's disease (PD) is one of the most widespread neurodegenerative conditions in the world [1]. It is an age-related disease and mostly affects people in the later years of life. As the older population continues to grow, the number of people with PD is expected to increase. Symptoms in PD include tremor in limbs, slowness of movement, stiffness in muscles, and impaired balance [1]. These symptoms result in a loss of fine motor skills. The progressive nature of PD and its increasing prevalence have resulted in a substantial economic burden to society, health care providers, individual patients and their family [2].

Researches have shown that physical exercise in patients with PD is an effective method to control PD-related symptoms, reduce or limit the progress of the disease, and improve physical and psychological health [3, 4]. However, due to PD related conditions such as dementia, apathy, excessive daytime sleepiness, and sleeping problems [5] exercise adherence is a challenging task. Adherence can be understood as the extent to which the patient's behavior corresponds with caregivers' recommendations and follows the mutual agreement to achieve established goals [6]. Since adherence to an exercise program often involves a behavioral change, the addition of support for this process might provide a valuable contribution to adherence. Adherence to exercise programs is fundamental for achieving positive outcomes.

Barriers for continuing regular exercise is decline in health, time constraints, and lack of motivation [7]. To our knowledge no previous studies have qualitatively explored the use of digital technology to facilitate exercise adherence after rehabilitation in people with PD.

The usage of smartphones and tablets is increasing among elderly. Various mobile apps have been developed for older adults [8]. Existing exercise apps for elderly people in general, such as Senior Fitness - Strength & Flexibility Training and Daily Senior Fitness Exercise, are not suitable for people with PD, as they do not consider their special conditions. Even the exercise apps for people with PD such as 9zest Parkinson's Therapy and Parkinson Home Exercises have usability issues. For example, some have an interface with buttons too close to each other, which causes mistakes for people with declined motor skills.

To support physical exercises among people with PD, we have designed a mobile exercise app that reminds and motivates people with PD to exercise, following guidelines and recommendations for mobile apps for people with PD and taking their special conditions into consideration. In addition, through the design of the app, we hope to test and contribute to the improvement of the existing guidelines and recommendations.

2 Related Work

The variety of symptoms for people with PD can make this user group difficult to design for and a user-centered design approach is important and efficient when designing solutions for people with PD [9, 10]. As basis for creating their own framework for people with PD, McNaney, Balaam, Holden, Schofield, Jackson, Webster, Galna, Barry, Rochester and Olivier [10] used existing guidelines for participatory design with elderly users. This method was found to inadequately address several specific issues with PD, including speech, general mobility and dexterity, medication, and age difference.

2.1 Mobile Apps for People with PD

Some mobile apps have been developed for people with PD, for training, self-management, monitoring progression, medication, diagnosis, treatment guides, information (about symptoms and treatment options), analyzing tremor, connecting (with family, experts, and peers), and transportation. Very few have been studied in terms of usability and effect [9, 11]. The Parkinson's tracker app for Android and iOS is a self-management and adherence tool to manage PD [12]. It was used in a study to investigate whether those who used the app showed improved medication adherence compared to those receiving usual treatment. Participants could review and compare their scores with each other, receive alerts and track medicine intake, they had the option to generate a report detailing the trial period, and play games to track physical responsiveness. The study lasted for 16 weeks and the app was found to have significantly improved adherence, compared to those who received usual treatment.

According to the authors, this study had a higher level of user retention because of the design of the user interface and user experience, and simplicity of the app.

2.2 Guidelines and Recommendations for Mobile Apps for People with PD

Tremor and loss of fine motor skills can cause great difficulty and frustration when using touchscreens for people with PD [10]. The challenges experienced are mostly related to touchscreen gestures [13]. The on-off phenomenon in PD can change the user's ability to interact with a touchscreen or smartphone depending on the situation. Montague, Nicolau and Hanson [14] recommends the use of alternative gesture recognition due to the variance in ability and performance between sessions in individuals with hand tremors.

Chen, Savage, Chourasia, Wiegmann and Sesto [15] studied the effects of button and gap size, and the presence of disability, including PD, on user performance using a touch screen kiosk. When button size increased, there was a decrease in misses, errors, and time to complete tasks. Ten combinations of five different button sizes and two different gap sizes were presented to each participant. Among those with a disability, 84% preferred a button size of 20 mm or larger, and 89% preferred a gap size of 3 mm over 1 mm.

Most recently, Nunes, Silva, Cevada, Barros and Teixeira [11] investigated how PD influences the interaction with smartphones. They researched relevant literature, interviewed healthcare professionals, observed smartphones users with PD, and performed a usability study with 39 people with PD. Four gestures were evaluated: tap, swipe, multiple-tap, and drag. In the end, a list of symptoms that influence smartphone interaction was provided, as well as 12 user interface design guidelines for developing smartphone applications for people with PD.

3 Design and Development

We follow a user-centered approach in the design and development of the mobile app. The initial requirements were gathered based on literature review and focus group interviews with people with PD and health care workers. Based on the requirements we have developed the first prototype.

3.1 Focus Group Interview

The focus group interviews were conducted in a rehabilitation center with 20 people with PD and 7 health care workers. The most pressing challenge is that after their stay in the rehabilitation center where they have learned how to exercise and live with PD, they have difficulties in following the exercise plan. Ideas for how to support the exercise adherence with the mobile app were discussed. These include showing videos of exercises, allowing care workers to add videos or links to online videos and create/customize exercise plan, reminding users to take medication, which is very important for the effect of physical exercises, and providing contact information to

doctor, physiotherapist, or other people who can help with exercises. Some people have also responded that they would like to have the app include functions for self-reporting, so that it can replace the use of paper forms for such purpose. Given the conditions of people with PD, the majority prefer to have the app on a tablet, which has a bigger screen size than a mobile phone.

3.2 Initial Prototype

Based on the results from the focus group interviews and conversations with experts in rehabilitation for people with PD, we established the initial requirements for the mobile app. They are: remind the user to exercise and take medication; show the user how to perform exercises; support user to create and customize exercise plan; and confirm that exercise has been performed.

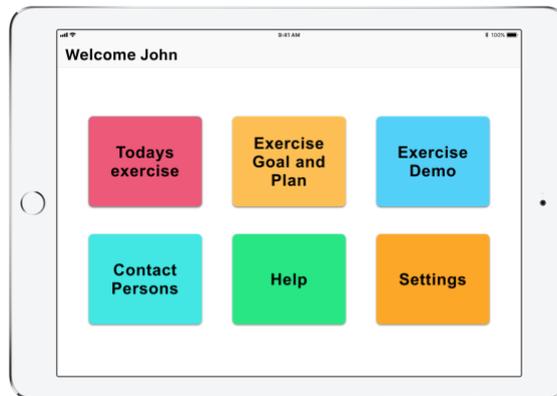


Fig 1. Main interface of the mobile app

Through literature review, we have also selected an initial set of design guidelines and principles to follow during the design of the interface for the exercise app. They are based on the 12 guidelines for designing for people with PD by Nunes, Silva, Cevada, Barros and Teixeira [11] and the 10 usability heuristics by Nielsen [16]. The interface of the prototype is illustrated in Fig. 1 where the users can see today's exercise, a demonstration of exercises, exercise plan, contact persons' information, help information on how to use the app, and how to configure reminders and other types of settings.

4 Conclusion and Future Work

In this paper we aim to address the challenges of exercise adherence among people with PD with developing a mobile app. This app is mainly intended to remind users to exercise and demonstrate to them how-to with videos. We are currently planning for the first user testing with the initial prototype. For the testing, we plan to use leading users who are in the early stage of PD and with reasonable good skills in using mobile phones or tablets. We will combine observation with think aloud protocol. After the

observation, an interview will be conducted to collect in-depth information about how the users have experienced the app. The feedback from the user testing will be used to further develop the app.

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